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A CATALYTIC HEATER AND HOW TO MAKE IT

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A Catalytic Heater and How to Make It

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A CATALYTIC HEATER AND HOW TO MAKE IT

[In the winter the amateur is triumphant . . . But let us say a word immediately: the approach of winter brings joy most of all to skiing and skating enthusiasts. The auto enthusiast is happy in the winter only if he is able to start the engine of his car. The cause for joy is fully supported; however, the procedure is complex. Today we would like to make some recommendations with respect to easing things.

The first author is Candidate of Technical Sciences V. Shikhov, an enthusiast fro' Sverdlovsk (the winters there are severe). He will tell us about a catalytic heater.]

If an automobile has stood through a long winter night in a cold garage, in the morning it is rather difficult to start the engine. In order to make it easier to start it is possible to use a flameless heater in which the vapor from liquid fuel (gasoline) is oxidized by the oxygen of the air in the presence of a catalyst.

There are many designs of catalytic heaters which differ mainly in size. Each of them consists of a reservoir for fuel, a wick device for feeding the fuel to the burner, and the catalyst itself which is applied to a porous material -- asbestos wadding. All these parts are mounted in a single body.

How does such a heater work?

Gasoline vapor begins to oxidize only at a high temperature. Therefore, in order to start the heater a small amount of gasoline is poured on the surface of the catalyst and is lit. The evaporation of the gasoline rising along the wick from the reservoir becomes more intensive; the vapor passes through the loose layer of fibrous asbestos and on the surface of the heated catalyst enters into a chemical reaction with the oxygen of the air. Thus individual foci of flameless combustion occur.

The more the catalyst is heated, the larger these foci become and the more quickly they merge forming a single ignited surface.

After starting, the heater does not require any interference and operates until the fuel is exhausted. In order to extinguish it it is sufficient to cover it tightly.

The heat output of the heater depends on the composition of the catalyst, the area of the burner, and the design of the heater and can range from 1800 to 10,000 large calories per hour.

A great advantage of flameless heaters is complete fire safety. The surface of the catalyst is heated to 400-800 degrees; however, there are no flames when gasoline vapor or oil land on it.

Catalytic heaters have been known for a long time. However, they are hardly used at all; a catalyst of platinum chloride is expensive. However, now there are new compositions for catalysts, at the basis of which are inexpensive materials which are not in short supply. Such, for example, are the triternary chromium catalysts which have been developed at the Ural Polytechnical Institute.

Many years of testing heaters with such catalysts for the free-starting heating of engines of automobiles ("Moskvich," "Pobeda," "Volga") have shown their sufficient reliability and convenience. They provide rapid starting of the engine and when carefully used can operate for several seasons without recharging.

The heater consists of a reservoir for the fuel and a catalytic burner. Both of these parts are mounted in a common welded body made of sheet iron of a thickness of 1 mm. The size of the heater is 240 x 400 x 185 mm. Wicks made of cord asbestos, the upper ends of which are flared, are lowered through a narrow crack into the reservoir. If the heater is of large size one should use fiber wicks and fill the lower space of the burner with asbestos wadding in order to prevent the burning of the upper ends of the wicks.

Two metal grids are placed in the heater on special fastening angles (10 x 10); between them is a uniform layer of fibrous asbestos impregnated with a catalyst. Along their edges the grids have a 5 mm border of iron which is 0.5 mm thick and they are connected with each other in 8-10 places with nickel-chrome wire. In order to seal the heater a frame of 5 mm wire covered with cord asbestos is placed under the lower grid on fastening angles. Above the metal grids with the catalyst fastenings pressed down making use of a fastening frame made from a 20 x 20 bracket. The cracks between the frame and the body are filled with cord asbestos.

In order to light the heater it is carried away from the vehicle

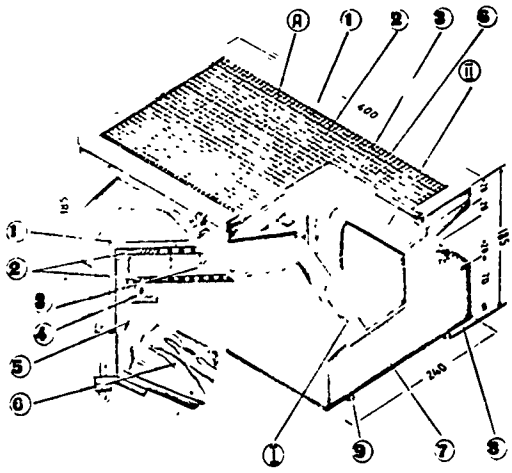
and 50-100 cc of gasoline are poured on the burner and are lit. In 3-4 minutes the flame goes out and the heated surface of the catalyst begins to burn without a flame. After this the heater is placed under the crankcase of the engine (or under the commutator) and soon the oil in the crankcase is heated to several degrees above 0, which makes for easy turning of the driveshaft by the starter or the crank. The height of the heater is such that the catalytic surface is at a distance of 5-10 mm from the base of the crankcase. If it is not possible to use an open flame near a garage, for heating a spiral made of nickel-chrome is placed in the catalytic layer and is connected to an electric circuit or to a battery.

The grids with the catalyst can be made in the form of a hut or can be given an undulating surface (across the long axis of the heater). Then the area of burning will increase by 2-5 times and there will be approximately the same increase in the heat output of the heater. However, in these cases it is more difficult to achieve even distribution of the catalyst between the walls.

For the heater it is possible to use a cobalt-chromium catalyst containing 27.3% CoO, 72.1% Cr_2O_3, and 0.6% MnO_2. It is made from pure "reagents" -- ammonium dichromate, manganese nitrate, cobalt nitrate, and concentrated ammonia.

The method of making the catalyst amounts to the fact that long-fiber asbestos (for example, brand Sh-1-40) during the course of an hour is impregnated with solutions of manganese and cobalt nitrate. For 1-- grams of asbestos 1000 cc of solution are required. Then to this one adds a solution of ammonium chromate prepared beforehand from ammonium dichromate and ammonia. Thereupon cobalt chromate is deposited on the asbestos wadding. The mass is dried at 100-120 degrees, is pulled, and is calcined for three hours at 350-400 degrees. After calcining the catalyst consists of loose dark asbestos wadding. It is placed evenly between the wire grids of the heater at the rate of 0.3 grams/cm^2. For the heater shown in the diagram it is necessary to have about 300 grams of catalyst.

When operating the heater the catalyst layer should be protected from water, oil, and dirt.



Key:

I. Fuel reservoir

II. Catalytic burner

1. Fastening frame

2. Metal grids

3. Asbestos wadding with catalytic impregnation

4. Cord asbestos

5. Fastening corner

6. Wick

7. Guard

8. Drain plug

9. Runners

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